

## Claims

What I claim as my invention is;

1. A method for the operation of a high yield softwood pulping process in a pulp mill using alkaline low sulfidity pulping liquors comprising the steps of;

5 a) contacting softwood chips with an aqueous impregnation solution comprising a quinone compound in an impregnation zone of a closed vessel at a temperature in the range from about 100 C to about 150 C and during a time period of from about 1 minute to about 120 minutes.

10 b) charging an alkaline cooking liquor to softwood chips recovered directly or indirectly from step a), said cooking liquor having a sulfidity level below about 25 %.

c) cooking impregnated softwood chips in the presence of said alkaline cooking liquor in a digester in order to obtain a brown pulp product in a yield ranging from 50 – 70 %.

15 d) extracting cellulose spent liquor comprising tall oil soap from step c).

e) removing tall oil soap from cellulose spent liquor and concentrating spent liquor in evaporators to provide a stream of concentrated spent black liquor.

f) transferring concentrated spent black liquor from step e) to a chemicals recovery plant.

20 the method characterized in that

g) a pH level below about 7 is maintained in the aqueous impregnation solution of step a) during at least a portion of said time period of from about 1 minute to about 120 minutes.

25 h) the alkaline liquor used in step b) comprises dissolved boron and alkali metal compounds said boron compounds being present in a concentration corresponding to a molar ratio of alkali metal to boron of from about 2:1 to about 10:1.

- i) further treatment of tall oil soap removed from cellulose spent liquor in step d) is performed by at least one of;
  - i1) reacting tall oil soap with a chemical compound substantially free from sulfur and,
  - 5 i2) burning tall oil soap or partly acidulated tall oil soap in a combustion plant capable of accommodating alkali metal containing fuels.
- 2. A method in accordance with claim 1 wherein the yield over the impregnation step a) calculated based on dry wood substance flow prior to charging alkaline cooking liquor in step b) and dry wood substance flow entering step a) is in the range of about 90 to 99  
10 %.
- 3. A method in accordance with claim 2 wherein said yield over the impregnation step a) is in the range of 95 to 98 %.
- 4. A method in accordance with claim 1 wherein a chemical compound substantially free from sulfur in step i1) is at least one of carbon dioxide, carbonic acid, boric acid,  
15 acetic acid, hydrochloric acid, nitric acid, oxalic acid, formic acid, acetic acid and boron tri fluoride.
- 5. A method in accordance with claim 1 wherein a quinone compound used in step a) is selected from the group consisting of naphthoquinone, anthraquinone, anthrone, phenanthrenequinone, octa- dimethyl anthraquinone and derivatives and salts thereof.
- 20 6. A method in accordance with claim 1 wherein the molar ratio of alkali metal and boron of step h) is from about 2:1 to about 4:1.
- 7. A method in accordance with claim 1 wherein the sulfidity of the alkaline cooking liquor of step b) is lower than about 10 %.
- 8. A method in accordance with claim 1 wherein spent impregnation liquor is removed  
25 from the impregnated chips stream prior to the charging of alkaline liquor to the chips in step b).
- 9. A method in accordance with claim 1 wherein spent impregnation liquor is removed from the impregnated chips stream prior to the charging of alkaline liquor to the chips

in step b) using an inverted top separator located inside a continuous digester or located in the chips feed stream to a continuous digester.

- 5 10. A method in accordance with claim 1 wherein the pH level in the impregnation zone of step a) is between about 2 to 5, said pH level achieved primarily by the in situ hydrothermal decomposition of softwood material and concurrent generation of organic acids.
- 10 11. A method in accordance with claim 1 wherein brown softwood pulp recovered from step c) is combined with bleached hardwood pulp in a paper mill producing multy-ply liner board products, said hardwood pulp being produced using a cooking liquor recovered from the chemicals recovery plant of step f).
12. A method in accordance with claim 10 wherein a quinone delignification catalyst is added to a cooking liquor or cooking circulation used in the preparation of bleached hardwood pulp.
- 15 13. A method in accordance with claim 1 wherein the cooking liquor charged to softwood chips in step b) consists primarily of alkali hydroxide, alkali metaborate and alkali carbonate dissolved in an aqueous solution.
- 20 14. A method in accordance with claim 12 wherein the alkali metaborate and alkali carbonate are present in the cooking liquor in a combined concentration which is higher than the combined concentration of other dissolved compounds in the cooking liquor.
15. A method in accordance with claim 1 wherein the alkaline cooking liquor of step b) is prepared without prior causticizing with lime or calcium compounds.
- 25 16. A method in accordance with claim 1 wherein softwood chips in a digester or softwood brown pulp recovered from step c) is subjected to treatment with an oxygen containing gas.
17. A method in accordance with claim 15 wherein treatment with an oxygen containing on softwood pulp is performed in a digester blowline before or after refining, in a brownstock washer or in a separate oxygen delignification reactor.